as new. *P. lanceolata hirta* Gray is *P. pumila* Nutt., and *P. Virginiana* Mill. is separated from *P. lanceolata* Michx., while *P. Virginiana* Gray and *P. viscosa* Pursh become *P. heterophylla* Nees. *P. ciliosa*, n. sp., is from the Gulf states, *P. rotundifolia*, n. sp., is from the West, *P. hastata*, n. sp., is from Lower California. The genus *Quincula* Raf. is recognized, and includes *Physalis lobata* Torr. *Leucophysalis* is a new genus constructed upon *Physalis grandiflora* Hook. It seems that *Chamæsaracha Coronopus*, as recognized, was a plexus, from which the author has separated *C. crenata*, n. sp., and *C. conoides* Britton (*C. sordida* Gray). *Orcytes* Wats. still remains a monotypic genus.—J. M. C.

NOTES FOR STUDENTS.

THE FIRST FASCICLE of *Pringle's Mexican Fungi* has recently been distributed by the Cambridge Botanical Supply Company. It consists of ten numbers, as follows: 1. *Puccinia heterospora* B. & C. on Anoda; 2. *P. heterospora* B. & C. on a malvaceous plant; 3. *Uromyces effusus* (Pk.) DeToni on Rhus Mexicana; 4. *U. Sophoræ* Pk. on Sophora sericea, uredospores; 5. Same, teleutospores; 6. *Æcidium Solani* Mont. on Solanum torvum; 7. *Æcid. Anisacanthi* Pk. on Anisacanthus virgularis; 8. *Parodiella perisporioides* (B. & C.) Speg. on Indigofera; 9. *Puccinia Tetramerii* Seym. on Tetramerium aureum; 10. *Leptostroma vestita* S. & P. on Agave vestita. The specimens are well put up and bear printed labels. The publication is edited by Mr. A. B. Seymour. Nos. 9 and 10 are new species; the descriptions accompany the specimens. They are also described in the *Botanical Notices*[3] of same date. As neither of these publications are likely to have a wide circulation, the descriptions are reproduced here.

Puccinia Tetramerii Seymour (Pringle's Mexican Fungi, No. 9, September 1, 1896).—Spots none; sori amphigenous, varying from minute to 5^{mm} in diameter, very dark; spores elliptical, covered with coarse blunt warts, dark, with broad and blunt apiculus somewhat lighter and occasionally a similar less prominent projection at side of spore; size of spore $11–15.5 \times 33–42\,\mu$; pedicels about $78\,\mu$ long, colored at junction with spore, otherwise hyaline, rough below.

On leaves of *Tetramerium aureum* Rose. Tomellin Cañon, Oaxaca, Mexico, November 30, 1895. Collector, C. G. Pringle.

Leptostroma vestita Seymour & Patterson (Pringle's Mexican Fungi, No. 10, September 1, 1896).—Amphigenous, mostly epigenous, stromata numerous, imbedded and slightly depressed, orbicular to oblong, $.5–1^{mm}$ (rarely to 2.5^{mm}), covering most of the upper leaf surface, distinct or often confluent, olive with a narrow black margin; conceptacles 2 to 5 in a stroma; spores hyaline, linear, multiguttulate, guttulæ often elongated and appearing like vacuoles; size of spores $30–85 \times 4\,\mu$.

On leaves of *Agave vestita* Watson. Barranca near Guadalajara, Mexico, May 1891. Collector, C. G. Pringle.—J. C. A.

[3] A trade publication in the form of a card catalogue issued monthly by the Cambridge Botanical Supply Co.

MANY BULLETINS of the agricultural experiment stations contain matter that borders more or less directly upon botany, or have botanical matter interspersed among other subjects, thus rendering them of some interest to botanists. Of recent issues of this character are the following: A. D. Selby has mapped out the distribution of peach yellows in Ohio (Bull. 72), showing it to occur along the shores of Lake Erie in the north and in one county in the south part of the state. Considerable information is given regarding this disease, and also that of black knot of plum, with remarks upon some other diseases of fruit trees. L. H. Bailey (Cornell Bull. 117) figures and describes root galls upon apple trees, and also discusses some causes of winter injuries to fruit trees. The relation of loss of moisture through the bark to hardiness is examined with some original data on the loss of moisture from twigs of apple. F. C. Stewart (N. Y. Bull. 101) gives results of spraying potato plants, describes the internal browning of the tubers, which was found experimentally not to be due to bacteria or fungi, and not to be transmissible to the succeeding crop, and also describes two new stem blights of which the cause was not ascertained for one, and for the other a new species of Fusarium (*F. acuminatum* E. & E.) was detected. Thomas A. Williams reports (S. D. Bull. 48) tests with corrosive sublimate, eau celeste, and Bordeaux mixture for prevention of potato scab, the first being found most effective. Luther Foster gives results (Mont. Bull. 9) of trials in growing potatoes, including treatment for scab. L. F. Kinney (R. I. Bull. 38) treats of the use of Bordeaux mixture in preventing the phytophthora disease of potatoes. F. M. Webster (Ohio Bull. 69) examines the claim that *Sporotrichum globuliferum* and similar fungi can be used to hold the spread of the chinch bug in check, and comes to the conclusion that "these fungous diseases, in order to work sufficiently rapidly and effectually to benefit the farmer, require peculiar meteorological conditions and a superabundance of insects at the same time." In a bulletin by H. H. Nicholson and T. L. Lyon (Neb. Bull. 44) some good data are recorded on the use of large and small beet seed, and also on heavy and light seed. In a bulletin on apple culture by L. F. Kinney (R. I. Bull. 37) record is made of the number of flower buds on limbs fully exposed to the light and those in shade on the same tree, the average of ten examinations, including several varieties, giving 182 buds upon limbs in full light to 136 buds upon limbs in partial shade. The relation of the Burrill cornstalk (bacterial) disease and of corn smut to the cornstalk disease of cattle is quite fully treated in a bulletin by N. S. Mayo (Kans. Bull. 58), with the conclusion that both these plant diseases cause no derangement or disease in animals. R. J. Davidson (Va. Bull. 50) gives the chemical analyses of different parts of the tobacco plant taken at different stages of development. B. C. Buffum (Wy. Bull. 29) describes, with illustrations, some experiments upon the effect of alkali upon germination and growth, to show the nature of alkali soils. The relation of soil moisture to vegetation is touched upon in a bulletin by L. A. Clinton (Cornell Bull. 120), and in one by F. W. Rane (N. H. Bull. 34), the latter treating of irrigation. —J. C. A.

THE BOTANICAL SEMINAR of the University of Nebraska has published, as a special brochure, an address recently delivered under its auspices by Professor Conway MacMillan, entitled "Some considerations on the alternation of generations in plants." The discussion is interesting and suggestive, and the "main contention" is summarized by the author as follows:

"The definition of rudimentary alternation should be widened so as to include rejuvenescence of the syngamete."

By "rudimentary alternation" is meant that form of it in which the indirect development of the sexually formed cell (syngamete) does not result in a distinctly organized body. In this category the author would include not merely the cases in which the syngamete produces directly several zoospores, as in Sphæroplea, but also those in which there is merely rejuvenescence, as in the zygospore of Spirogyra.

"Indirect development of a cell resulting from a sexual process is most fundamentally a sensitization and serves to compensate for that general sexual immobility which arises from the preponderant constructive chemism of plants."

Alternation of generation is generally spoken of as a device by which the product of the sexually formed cell is multiplied, and hence the more highly developed the sporophyte the greater the advantage. Our author, however, sees in it something deeper, which he calls "sensitization," by which he means the bringing of a syngamete cell "into more intimate reciprocal relations with the environment," as seen in a primitive way in rejuvenescence. This, he thinks, is an offset to the general stability of plants, a stability which follows from their essentially constructive character, as opposed to the destructive character of animals.

"Further development of alternation is accentuated by cleavage phenomena in the egg, and eventually a group of blastomeres becomes integrated as such and is the sporophyte. This body is peculiarly a plant product and in its origin and progressive specialization is as distinctly a structural response to the plant type of chemism as the head is a structural response to the animal type of chemism. Sporophytization, therefore, in the plant phylum, is a phenomenon of coordinate importance with cephalization in the animal, and homologies between the vegetative tracts of the higher plants and higher animals lie below the plane of the cell unit."

The author also presents a "classification of alternation of generations," which may be of interest to some as a new setting for old facts.

Alteration types.
- A. Recapitular alternation.
- B. Heteroblastic development.
- C. Sprout alternation.
- D. Homologous alternation.

Alternation types.
- A. Rudimentary alternation.
  - I. Rejuvenescence alone.
  - II. Rejuvenescence with segmentation.
  - III. Segmentation alone.
- B. Discrete alternation.
- C. Concrete alternation.
- D. Symbiotic alternation.

"Recapitular alternation" refers to "the passage from the vegetative multicellular to the reproductive unicellular condition;" "heteroblastic development" refers to such an alternation as that of Chantransia and mature Batrachospermum forms; "sprout alternation" defines itself; "homologous alternation" occurs where a potential gametophyte alternates with an actual gametophyte. These are styled "alteration types." The true alternation types are defined as follows: "Rudimentary alternation," defined above;" "discrete alternation," as in archegoniate plants (exclusive of gymnosperms); "concrete alternation," as among the Florideæ; and "symbiotic alternation," as in spermatophytes.—J. M. C.

MR. HAROLD WAGER has noted several new features in the development of the sexual organs of *Cystopus candidus*.[4] When these organs have reached their full size the oogonium contains 64 to 115 nuclei, and the antheridium 6 to 12. The protoplasm of the oogonium contracts toward the center, forming a central vacuolated mass surrounded by a denser layer, the periplasm. The nuclei divide and pass out into the periplasm, and one of these daughter nuclei moves toward the center and becomes imbedded in a dense mass of protoplasm which has collected there. Meanwhile the antheridial tube is being formed, and after nuclear division a daughter nucleus passes to the tip of the tube. When the tube reaches the dense mass containing the female pronucleus, the male pronucleus is discharged. A wall now appears around the oosphere, inside the periplasm. Fusion of the pronuclei soon follows. The fusion nucleus divides into two, and division continues until 32 nuclei are formed. This number is found in the resting oospore. Germination of the oospore was not observed. The division of nuclei in the sexual organs can hardly be regarded as a reduction process, for 20 to 24 chromosomes are found in the oosphere nuclei, and only 12 to 16 in the nuclei of the oogonium.—W. D. M.

MISS ETHEL SARGENT has investigated the formation of the sexual nuclei in *Lilium Martagon*.[5] The resting, vegetative nucleus contains a substance which she calls "amorphous chromatin." This is not present in the spirem stage, but the increased amount of chromatin in ribbon may account for its disappearance. The chromosomes split longitudinally after they have taken

[4] Annals of Botany **10**: 295, 1896.

[5] Annals of Botany **10**: 107, 1896.

their place to form the nuclear plate. In the resting stage the primary nucleus of the embryo-sac has the vegetative characters, but as division approaches the chromatin thread contracts to one side of the nuclear cavity, the nucleolus partially dissolves, and there is also a partial disappearance of the nuclear membrane. The nucleoli and membrane reappear in the spirem stage. The spirem of the embryo-sac nucleus differs decidedly from the vegetative type. The ribbon of the vegetative spirem stains like chromatin, but in this spirem there is an erythrophilous ribbon bordered by chromatin. Longitudinal fission of the entire ribbon takes place before segmentation into the lengths which become the chromosomes. The nuclei resulting from the second and third embryo-sac divisions resemble the primary nucleus in the staining of the ribbon, but otherwise they follow the vegetative type. After the second division the lower antipodal nucleus divides by the direct method.

The number of chromosomes in vegetative nuclei is generally about twenty-four; in the primary nucleus of the embryo-sac, twelve; but after its first division the micropylar nucleus has twelve, while the antipodal may have from twenty to thirty-two. Throughout the oogenesis twelve chromosomes seems to be a constant number for the micropylar end of the sac, but in the antipodal end the number varies from twenty to thirty-four. The transverse division of chromosomes, which Dr. Haecker suggested might precede the formation of the sexual nucleus, does not occur.—C. J. C.

SEVERAL physiological papers have recently been printed by Professor D. T. McDougal of the University of Minnesota, in part based upon experimental data, and in part upon critical deductions from the works of others. Additional papers on the same subjects are in course of publication, but those already upon the table are of sufficient importance to merit present attention.

His initial study, the mechanism and procedure of tendrils by which coiling is effected, has given, perhaps, the most important results.[6] Begun in the physiological laboratory of Purdue University in 1891, and continued as occasion permitted since, it has illuminated a number of obscure points, and done much toward making the whole matter of tendril movement understandable. The complex nature of the phenomenon is shown by the previous lack of discrimination between the act of coiling of the free part of the tendril, a function of maturity, and the sensitive response to contact.

The generalization is especially helpful that a class of plant movements dependent upon rapidity for effectiveness are only indirectly associated with

[6] For the earlier papers see this journal **17**: 205–212. *pl. 14.* 1892; **18**: 123–130. *pl. 10.* 1893; and Bot. Centralblatt **66**: 145, 146. —. The recent papers are two: "Ueber die Mechanik der Windungs- und Krümmungsbewegungen der Ranken," Ber. d. d. bot. Gesellschaft **14**: 151–154. 1896, and "The mechanism of curvature of tendrils," Annals of Botany **10**: 373–402. *pl. 19.* 1896.

growth and are brought about by the contraction of the concave side, while a class of movements where position is secured slowly, as heliotropic and geotropic curvature, are directly associated with growth and are brought about by elongation of the convex side. In Passifloreæ the region of maximum growth never coincides with the region of maximum irritability.

The morphological nature of tendrils is various, and the assumption that they may have various methods of producing movement is well made. The chief study has been given to tendrils of Passifloreæ and Cucurbitaceæ, which have similar structure. It is found that the pull of a stimulated tendril amounts to less than one-half gram, while that of a free coiling tendril is twenty to sixty times as great. In the first case rapidity of movement is the essential feature, and in the second the production of strains. By a variety of studies, including plasmolysis, it was ascertained that tendril movement in the two families named is always due to shortening of the concave side, a point which has been much in controversy.

The author brings support from various sources, including anatomical, for his conclusion that the cause of coiling resides in the irritability of protoplasm of the concave side, by which the protoplasts are rendered more permeable, water passing into the intercellular spaces, thus allowing the previously stretched cell walls to contract. Space does not permit mentioning other parts of the investigations.

A summary of present knowledge on the physiology of color in plants[7] shows that non-green colors convert the sun's rays into useful heat and in some parts of the plant promote transpiration, or are occasionally waste products of metabolism. Colors in some cases, as is well known, also hold relation to insect pollination and to protection from injury. Chlorophyll is also to be included as a very useful color.

The influence of carbon dioxide on the living protoplasm[8] appears to be characteristic. Its effects do not result from the simple exclusion of oxygen, but its action is upon the nutritive processes. Its stimulating action, if any, appears to be small.—J. C. A.

ITEMS OF TAXONOMIC INTEREST are as follows: Five new North American species of Saxifraga have been described by Dr. John K. Small.[9] A good figure of the very rare *Berberis Nevinii*, from the sandy plains near Los Angeles, has just been published.[10] *Lindauea* is the name of a new genus of African Acanthaceæ, dedicated by Dr. Donaldson Smith[11] to Dr. Gustav Linden. Professor E. L. Greene has issued another fascicle[12] of new and noteworthy species, describing two new species of Ranunculus, three of

[7] Pop. Sci. Monthly 49:71. 1896; Science 4:350. 1896.

[8] Science 3:689. 1896.

[9] Bull. Torr. Bot. Club 23:362. 1896.

[10] Garden and Forest 9:415. 1896.

[11] Jour. Bot. 34:411. 1896.

[12] Pittonia 3:91–98. 1896.

Delphinium, three of Roripa, and one of Berberis. He also takes up Sophia for *Sisymbrium incisum* and its allies, as an older generic name than Descurainea, adopted by Engler and Prantl, and proposes a new genus, Neobeckia, to include the watercress and horse-radish types of Nasturtium (Roripa), *N. lacustre* of the *Synoptical Flora* becoming *Neobeckia aquatica*. Miss Alice Eastwood[13] has described seven new Californian species belonging to the genera Sedum, Anemone, Hosackia, Lupinus, Heuchera, Brodiæa, and Cynoglossum. Mr. Robert Ridgway has suggested[14] the possibility of two native species of Tecoma, describing the forms as they have come under his observation, but applying no names. Mr. J. G. Baker[15] has concluded his synopsis of the genus Brodiæa, the last part touching upon several North American species. Mr. J. W. Toumey has described[16] a new Opuntia from Arizona, one of the shrubby cylindropuntias. M. A. Franchet has concluded his account of new Chinese plants.[17] The last part contains descriptions of twelve new species of Lonicera. Dr. C. Hart Merriam has described[18] a new Abies from Arizona. It is from the San Francisco Mountain region, and is remarkable for the color and character of its bark, being one of the most conspicuous trees on the mountain between the altitudes of 8950 and 9500 ft. The substance of the technical description is as follows:

ABIES ARIZONICA. About 15^{m} high: bark a highly elastic fine grained cork, whitish or grayish (usually creamy white), with irregularly sinuous grayish ridges: leaves of cone bearing branches thick, subtriangular in section, sharp-pointed at apex, about 2^{cm} long; leaves of lower branches much longer, flatter, blunt and notched at apex, 2.5 to 3^{cm} long: cones dark purple, slender, medium or rather small; scales much broader than long, strongly convex laterally, purple on both sides; bract (without awn) reaching to or past middle of scale, its body much broader than long.

A full account of *Aspidium cristatum* × *marginale* Davenport, published in this journal,[19] has just been given[20] by the author in connection with a Faxon illustration. A revision of the North American species of Cephalozia has been published by Professor L. M. Underwood.[21] In the fourth part[22] of Mr. P. A. Rydberg's Notes on Potentilla four new species are described. In his studies in the botany of the southeastern United States Dr. John K. Small[23] describes a new Rumex from Louisiana, revises the genera Polygonella and Warea, and substitutes Yeatesia for the previously used Gatesia of Gray.

[13] Proc. Calif. Acad. II. **6**: 422–430, *pl. 53–59*. 1896.

[14] Garden and Forest **9**: 453. 1896.

[15] Gardener's Chronicle III, **20**: 459. 1896.

[16] Garden and Forest **9**: 432. 1896.

[17] Jour. de Botanique **10**: 309. 1896.

[18] Proc. Biol. Soc. Washington **10**: 115–118. 1896.

[19] Bot. Gazette **19**: 494. 1896.

[20] Garden and Forest **9**: 444. 1896.

[21] Bull. Torr. Bot. Club **23**: 381. 1896.

[22] Bull. Torr. Bot. Club, *l. c.* 394.

[23] Bull. Torr. Bot. Club, *l. c.* 405.